WEYERHAEUSER FOREST PRODUCTS

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WOOD CONVERSION CO.

CLOQUET, MINNESOTA

SHELF FILE INDEX

Balsam·Wool Blanket

Heat and Sound Insulation

...le No.

For the Specification Writer

To facilitate the writing of specifications, the following chart is arranged for the use of the specification writer. Fill in the job number in the space provided and with a soft pencil place a small check mark in the squares opposite the applications desired for the job. Your secretary can then turn to the section, page, and paragraph given and copy the specifications. When the specifications are completed, the pencil marks can be erased and the chart is ready for the next job. Spaces are provided for a number of jobs so that several specifications can be written simultaneously.

While only one specification for roof or ceiling insulation is given to match the application for side wall insulation, the roof and ceiling specifications are interchangeable.

HEAT INSULATION—Side Walls:

	Job No. ____	Job No. ____	Job No. ____	Job No. ____	Job No. ____	Job No. ____
1. Frame, Brick Veneer, Frame Stucco Construction						
A. Insulation flanged between studding—Section 3, Page 3, Paragraphs 1 and 2..................................	☐	☐	☐	☐	☐	☐
B. Insulation applied to face of studding—Section 3, Page 5, Paragraphs 1, 2 and 3................................	☐	☐	☐	☐	☐	☐
2. Masonry Construction						
A. Insulation applied to masonry walls, double furring strip—Section 3, Page 7, Paragraphs 1 and 2..................	☐	☐	☐	☐	☐	☐
B. Insulation applied to masonry walls, single furring strip—Section 3, Page 7, Paragraphs 3, 4 and 5.................	☐	☐	☐	☐	☐	☐

HEAT INSULATION—Roof and Ceiling:

	Job No.	Job No.	Job No.	Job No.	Job No.	Job No.
1. Insulation at Roof Line						
A. Insulation flanged between rafters—Section 3, Page 3, Paragraphs 3 and 4..................................	☐	☐	☐	☐	☐	☐
B. Insulation applied to face of rafters—Section 3, Page 5, Paragraphs 4 and 5..................................	☐	☐	☐	☐	☐	☐
2. Insulation at Ceiling Line						
A. Insulation flanged between joists—Section 3, Page 3, Paragraphs 3 and 5......................................	☐	☐	☐	☐	☐	☐
B. Insulation applied to underside of ceiling joists—Section 3, Page 5, Paragraphs 4 and 6..........................	☐	☐	☐	☐	☐	☐

SOUND INSULATION—Floors:

	Job No.	Job No.	Job No.	Job No.	Job No.	Job No.
1. Wood Joist Construction						
A. Insulation applied with suspended ceiling construction—Section 4, Page 3, Specification No. 1...................	☐	☐	☐	☐	☐	☐
B. Insulation applied between rough and finished floors—Section 4, Page 4, Specification No 2....................	☐	☐	☐	☐	☐	☐
C. Insulation applied between rough and finished floors when electric conduit pipe is used—Section 4, Page 5, Specification No. 3..	☐	☐	☐	☐	☐	☐
2. Fireproof Construction						
A. Insulation applied on concrete floors—Section 4, Page 6, Specification No. 4....................................	☐	☐	☐	☐	☐	☐

SOUND INSULATION—Partitions:

	Job No.	Job No.	Job No.	Job No.	Job No.	Job No.
1. Wood Construction						
A. Insulation woven between two sets of staggered studding—Section 4, Page 7, Paragraphs 1 and 2.................	☐	☐	☐	☐	☐	☐
B. Insulation applied to both sides of studding—Section 4, Page 7, Paragraphs 1 and 3...........................	☐	☐	☐	☐	☐	☐
C. Insulation applied to one face of studding—Section 4, Page 7, Paragraphs 1 and 4.................................	☐	☐	☐	☐	☐	☐
Fireproof Construction						
A. Insulation applied between double gypsum block partition walls—Section 4, Page 9, Paragraphs 1 and 2............	☐	☐	☐	☐	☐	☐
B. Insulation applied to single gypsum block partition wall—Section 4, Page 9, Paragraphs 1 and 3..................	☐	☐	☐	☐	☐	☐

Balsam-Wool Insulation

WOOD CONVERSION COMPANY
CLOQUET, MINNESOTA

SECTION I

General Information on Balsam-Wool for Heat and Sound Insulation

What Balsam-Wool Is

A wood product BALSAM-WOOL Standard Building insulation is a blanket form of heat and sound insulation. It is made of wood fibres in fleecy wool form permanently matted together between two sheets of asphalt-coated, tough, flexible, creped Kraft paper.

Qualities of Balsam-Wool

Highly efficient heat insulator There are two factors responsible for the high efficiency of BALSAM-WOOL as a heat insulator; namely, the materials used and the manner in which they are put together. A wood product, BALSAM-WOOL takes advantage of all of the natural heat resistance of wood multiplied many times by a rearrangement of the cellular wood fibres into a "wool" form containing millions of dead air cells. Thus the light weight and low density of BALSAM-WOOL add to its insulating efficiency. The fact that the paper liners on BALSAM-WOOL are not stitched or punctured in any way further increases its resistance to the passage of heat, wind and moisture.

And sound-deadener The ability of the "wool" in BALSAM-WOOL to absorb sound and the tendency of the paper covering to reflect sound waves account for its remarkable efficiency as an insulation against the transmission of sound.

Water-proof The water-proof film of asphalt with which the paper coverings are lined protects the "wool" from moisture and thus assures its high insulating efficiency throughout the life of the building. The asphalt coating also keeps dampness out of the building.

Tough, durable The Kraft paper liner used in the manufacture of BALSAM-WOOL is a Weyerhaeuser quality product. Creped by a patented process, it is capable of 25% stretch which makes it virtually puncture-proof. BALSAM-WOOL is protected against decay by a special chemical treatment of the fibres in the process of manufacture.

Fire-resistant In the manufacturing process the wood fibres in BALSAM-WOOL are chemically treated to make it fire-resistant. It will char while exposed to flame but it will not smolder or burn after the flame is removed. BALSAM-WOOL in itself will not support combustion. It has been passed by the building commission in every city where such tests are required.

Vermin-proof and sanitary BALSAM-WOOL does not attract or harbor rats, mice or vermin. BALSAM-WOOL does not contain animal matter. It is clean, odorless and sanitary.

Permanent Once in place in a building BALSAM-WOOL is there to stay. It cannot sift or settle because each fibre is coated with an adhesive which cements it to adjacent fibres. The asphalt coating provides a permanent bond between "wool" and paper. BALSAM-WOOL is as permanent as the walls that hold it.

Uniform in quality During the process of manufacture BALSAM-WOOL is under constant laboratory control for uniform density, thickness, and thermal conductivity.

Practical equivalent of sheep's wool at one-fifth the cost BALSAM-WOOL contains all the desirable qualities which combined make an ideal insulation. These qualities considered, BALSAM-WOOL gives the greatest insulating efficiency per dollar invested. In BALSAM-WOOL you obtain the practical equivalent of sheep's wool in insulating efficiency at a fraction of its cost.

The Mechanical Resistance of Balsam-Wool

Does not sift down Reference has been made to the permanence of BALSAM-WOOL and the fact that it does not settle or sift down. This quality was proved conclusively in a series of tests conducted to determine the suitability of BALSAM-WOOL for railroad refrigerator car insulation.

Nature of the tests A testing device was built which duplicated the jarring, racking motion of a refrigerator car. Pieces of various insulating materials were applied to the framework of this machine which then received abuse in the form of jolting, jarring and racking equivalent to approximately 60,000 miles of travel over a track with each rail ¼-inch out of alignment.

Test results This particular test was made on the "wool" alone. In spite of the fact that the material did not have the protection of the paper liners it remained intact at the end of the test. Throughout the entire series of tests BALSAM-WOOL showed a remarkable resistance to sifting and disintegrating.

A piece of Balsam-Wool Blanket with the paper liner removed from one side. Note the striking resemblance to sheep's wool. Balsam-Wool provides the practical equivalent of sheep's wool in insulating efficiency at a fraction of its cost.

This machine was designed to duplicate the jarring and weaving motion of a freight car. The Balsam-Wool without the paper liners (Panel No. 3) received abuse equivalent to 60,000 miles of travel before this photograph was taken.

Balsam-Wool is Flexible

A heat-tight job BALSAM-WOOL is flexible. It fits snugly between studdings, joists and rafters—an application proved by test to be the most efficient and practical method of installing insulation. It tucks into the corners. It fits around projections without a lot of cutting and notching. It caulks the cracks. Because of its flexibility there are no "hard places" to insulate with BALSAM-WOOL, and its use is an assurance of a satisfactory, heat-tight job.

Low cost of installation BALSAM-WOOL is made in widths to fit all standard construction specifications. It is light in weight and easy to handle. The carpenter cuts to necessary lengths—no waste. Records covering many types of construction show exceedingly low installation costs.

Applying one-inch Balsam-Wool between studding.

Radiation Requirements

Radiation requirements should be measured on the premise of insulated or uninsulated construction. Buildings insulated with BALSAM-WOOL as compared to uninsulated construction require less radiation. This saving on heating equipment pays all or at least a large part of the cost of the insulation. This subject is covered in detail in Section Two of this series.

Engineering service An Engineering Service Department which will gladly co-operate with architects in the solution of all insulation problems is maintained by the makers of BALSAM-WOOL. This service includes the calculation of the necessary radiation based on the coefficients given in Section Two.

Personal service This company maintains district sales offices in many of the principal cities and resident representatives in many more. The name, address and telephone number of the representative nearest you is listed on this File Folder. He is thoroughly trained in all phases of insulation and will gladly render complete architect's service, including inspection of BALSAM-WOOL application on any job from your office.

Standard Form of Balsam-Wool

For heat insulation and sound-deadening in buildings, BALSAM-WOOL comes in one standard form. The fibre mat is covered on each side with asphalt-coated, tough, creped, Kraft paper liners.

Standard Sizes

BALSAM-WOOL for building insulation comes in three standard widths—17-inch, 25-inch, and 33-inch, and in two standard thicknesses ½-inch and 1-inch. It is securely wrapped in heavy paper, insuring the delivery of each roll on the job in a usable condition.

A Weyerhaeuser Product

Assurance of satisfaction BALSAM-WOOL is a Weyerhaeuser product. It bears the name of an organization known for more than seventy years for the high standard of quality maintained in all its products. On every roll of genuine BALSAM-WOOL you will find the Weyerhaeuser Forest Products trade-mark, the maker's pledge of personal responsibility.

Sold by Lumber Dealers

BALSAM-WOOL Standard Building Insulation is distributed through retail lumber dealers. Dealers in all sections are now carrying stocks. Any retail lumber dealer can obtain a supply promptly.

Showing application of one-inch Balsam-Wool between the attic floor joists in an old home.

Balsam-Wool Insulation

WOOD CONVERSION COMPANY
CLOQUET, MINNESOTA

SECTION 2

Heat Transmission Coefficients for the Calculation of Radiation Requirements and Fuel Saving

Radiation Reduction

Standard practice It is now a generally accepted practice to reduce the amount of radiation in a heat-insulated house as compared to one uninsulated. Both in laboratory tests and actual practice it has been proved beyond question of doubt that the house properly insulated with BALSAM-WOOL can be comfortably heated with 20% to 30% less radiation and a smaller boiler than the same house unprotected against loss of heat.

Savings Since heating equipment is one of the costly items in house construction it is evident that a reduction of 20% to 30% in radiation together with a smaller boiler means a substantial and worth-while saving to the builder. In most cases this initial saving is enough to pay all or at least a large part of the cost of the BALSAM-WOOL.

More wall space Radiation reduction has another important advantage in the additional wall space it provides. Frequently the cutting off of a few coils from the radiator in the living room or bedrooms means just enough extra wall space to take care of an additional piece of furniture.

Test data To assist heating engineers and architects in figuring the radiation required for houses insulated with BALSAM-WOOL, coefficients for various types of wall, ceiling and roof sections are shown on the following pages. The value for BALSAM-WOOL used in computing these coefficients is the result of tests made by unbiased authorities and in accordance with standard testing methods. The results of these tests are shown in the table below.

There are three accepted methods for determining the passage of heat through materials. The hot plate is used for measuring the conductivity of individual materials, the hot box for measuring the heat transmission of built-up sections, and the Nicholls Heat Meter for determining the conduction of structures already built.

Table I—Test Results

HOT PLATE METHOD

Material	Mean Temp.	Thermal Conductivity Per Inch Thick.	Authority
Balsam-Wool	70° F.	.246	Peebles
Balsam-Wool	90° F.	.27	Bureau of Standards

HOT BOX METHOD

Description	Mean Temp.	Heat Transmission Factor U	Authority
*3/8″ Wood Lath and 3/8″ Plaster, 3/4″ fir sheathing, building paper, 4″ lap siding, insulation "C", flanged midway in air space between studding.	40.2° F.	.115	Rowley

*Taken from Journal of A. S. H. & V. E., Vol. 34, No. 7 (July, 1928), Page 536.
Insulation "C"—1/2″ Balsam-Wool.

Method Used in Computing Transmission Coefficients

Note: While some of the coefficients for various types of building construction have been determined by actual test, it is still necessary to compute many of them by combining the conductivities of the materials used. With the conductivities of the various materials and the effect of air spaces as known factors, it is possible to compute with accuracy the coefficients for built-up sections.

Results of hot box tests made for the A. S. H. & V. E. by Professor F. B. Rowley, University of Minnesota, on built-up wall sections insulated with Balsam-Wool check closely with the computed values for the same walls.

The following method for computing coefficients was first set forth by Rietschel and is the one used by leading authorities today.

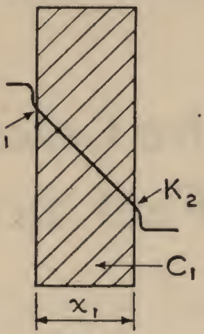


Fig. 1

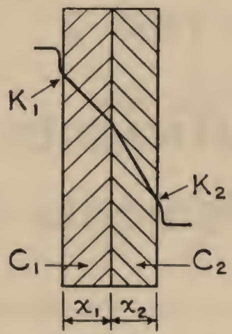


Fig. 2

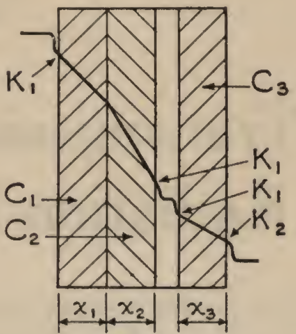


Fig. 3

For a simple wall of one material (**Fig. 1**) .... $$U = \frac{1}{\frac{1}{K_1} + \frac{X}{C} + \frac{1}{K_2}}$$

For a composite wall, having no air space (**Fig. 2**) ..... $$U = \frac{1}{\frac{1}{K_1} + \frac{X_1}{C_1} + \frac{X_2}{C_2} + \frac{1}{K^2}}$$

For a composite wall, with air space (**Fig. 3**) .... $$U = \frac{1}{\frac{1}{K_1} + \frac{X_1}{C_1} + \frac{X_2}{C_2} + \frac{1}{K_1} + \frac{1}{K_1} + \frac{X_3}{C_3} + \frac{1}{K_2}}$$

In the above formulae:

U = B. t. u. transmitted per hour per sq. ft. per degree difference in air temperature on either side of the section.
K_1 = surface constant with still air (inside)
K_2 = surface constant with moving air (outside)
C_1 C_2 C_3 = conductivities of the respective materials in the section per inch of thickness per sq. ft. per hour per degree difference in surface temperature.
X_1 X_2 X_3 = thickness in inches of the respective materials in the section.

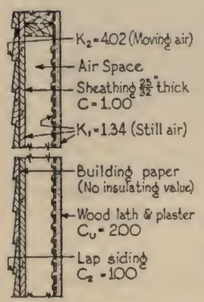


Fig. 4

Illustrative Problem:

To determine the transmission factor for a wall section composed of:

(a) Lap-siding, paper, sheathing, studding, lath and plaster (**Fig. 4**)

$$U = \frac{1}{\frac{1}{4.02} + \frac{.625}{1} + \frac{.781}{1} + \frac{1}{1.34} + \frac{1}{1.34} + \frac{1}{2.00} + \frac{1}{1.34}} = 0.227$$

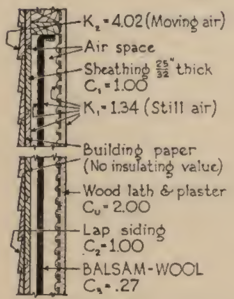


Fig. 5

(b) Insulated with ½-inch Balsam-Wool flanged in air space midway between lath and sheathing (**Fig. 5**)

$$U = \frac{1}{\frac{1}{4.02} + \frac{.625}{1} + \frac{.781}{1} + \frac{1}{1.34} + \frac{1}{1.34} + \frac{.63^*}{.27} + \frac{1}{1.34} + \frac{1}{1.34} + \frac{1}{2.00} + \frac{1}{1.34}} = 0.122$$

*Actual thickness of ½-in. B. W. = .63 in. Actual thickness of 1-in. B. W. = 1.13

Tables for Use in Calculating Heat Transmission

Table II

CONDUCTIVITY COEFFICIENTS FOR VARIOUS BUILDING MATERIALS

C = B.t.u. per sq. ft. per hour per 1° F. temperature difference per 1″ thickness

	C
Wood	
Pine	1.00
Maple	1.20
Oak	1.30
Fir	1.00
Plaster	
Gypsum	2.32
Cement	8.00
Masonry	
Brick	5.00
Limestone	10.00
Concrete (1-2-4 mix)	8.30
Concrete (cinder)	5.20
Concrete Blocks	4.84
* 2″ Hollow Tile	1.14
* 4″ Hollow Tile	.65
* 6″ Hollow Tile	.50
* 8″ Hollow Tile	.43
*12″ Hollow Tile	.26
General	
*Wood Lath & Plaster	2.00
*Asphalt or Composition Roofing	6.50
*Asbestos Shingles	6.00
*Slate Shingles	10.37
*Glass, Single	1.10
*Glass, Double	.55
*Doors, Wood—2″	.38

*Per thickness as applied—not per 1″.

Table III

NUMBER OF AIR CHANGES PER HOUR EXCLUSIVE OF VENTILATING EQUIPMENT

Basement Rooms	½-1
Rooms, One Side Exposed	1
Rooms, Two Sides Exposed	1½
Rooms, Three Sides Exposed	2
Garages	1-2
Entrance Halls	2-3
Bathrooms	2-3
Rooms with Fireplaces	2-3

Table IV

AIR COEFFICIENT

B. t. u. per cu. ft. per 1° F. temperature difference

½ change per hour	.009
1 " " "	.018
1½ " " "	.027
2 " " "	.036
3 " " "	.054

Table V

DURATION OF HEATING SEASON IN DEGREE-DAYS IN VARIOUS CITIES

Atlanta, Ga.	2880
Atlantic City, N. J.	5250
Baltimore, Md.	4591
Boise, Idaho	5657
Boston, Mass.	6055
Buffalo, N. Y.	6750
Chicago, Ill.	6007
Cincinnati, Ohio	5302
Cleveland, Ohio	6096
Dallas, Texas	2455
Denver, Colo.	5880
Des Moines, Iowa	6464
Detroit, Mich.	6202
Duluth, Minn.	9650
Fargo, N. D.	9495
Fort Wayne, Ind.	5927
Grand Forks, N. D.	9724
Grand Rapids, Mich.	6613
Green Bay, Wis.	8201
Indianapolis, Ind.	5331
Jacksonville, Fla.	1080
Kansas City, Mo.	5302
Lansing, Mich.	6957
Los Angeles, Cal.	1517
Louisville, Ky.	4366
Madison, Wis.	7251
Marshalltown, Iowa	7103
Milwaukee, Wis.	7366
Minneapolis, Minn.	7953
New Haven, Conn.	6039
New York, N. Y.	5303
Oklahoma City, Okla.	3827
Omaha, Neb.	6127
Philadelphia, Pa.	4950
Pittsburgh, Pa.	5327
Portland, Me.	7267
Portland, Ore.	4449
Richmond, Va.	3789
Rockford, Ill.	6847
San Francisco, Cal.	3450
Seattle, Wash.	5156
Sioux Falls, S. D.	7683
South Bend, Ind.	6313
Spokane, Wash.	6085
Springfield, Ill.	5495
Springfield, Mass.	6464
St. Louis, Mo.	4583
Toledo, Ohio	6107
Tulsa, Okla.	3497
Washington, D. C.	4562
Waterbury, Conn.	5661
Wichita, Kan.	4675

Table VI

Heat Transmission Coefficients for Various Types of Building Construction

U=B. t. u. transmitted per hour per sq. ft. per degree difference in air temperature on either side of the section.

Section No.	TYPE OF CONSTRUCTION — Walls, Masonry	Plastered Direct	Furred Wood Lath & Plaster	½″ B-W Single Furring	½″ B-W Double Furring	1″ B-W Single Furring	1″ B-W Double Furring
1	9″ Brick	.332	.209	.141	.116	.112	.096
2	13″ Brick	.263	.179	.127	.107	.103	.089
3	18″ Brick	.208	.152	.113	.097	.093	.082
4	6″ Hollow Tile, Stucco	.299	.196	.135	.112	.108	.093
5	8″ Hollow Tile, Stucco	.273	.184	.129	.108	.104	.090
6	12″ Hollow Tile, Stucco	.193	.144	.108	.093	.090	.079
7	4″ Brick Veneer, 4″ H.T.	.277	.186	.130	.109	.105	.091
8	4″ Brick Veneer, 6″ H.T.	.246	.171	.122	.104	.100	.087
9	4″ Brick Veneer, 8″ H.T.	.228	.162	.118	.100	.097	.084
10	4″ Brick Veneer, 12″ H.T.	.169	.130	.100	.087	.084	.075
11	12″ Stone	.415	.239	.154	.125	.120	.102
12	16″ Stone	.356	.218	.145	.119	.114	.098
13	20″ Stone	.311	.200	.136	.113	.109	.094
14	8″ Concrete, Stucco	.437	.246	.157	.127	.121	.103
15	10″ Concrete, Stucco	.395	.232	.151	.123	.118	.100
16	12″ Concrete, Stucco	.361	.220	.146	.120	.115	.098
17	16″ Concrete, Stucco	.308	.199	.136	.113	.109	.094
18	6″ Cinder Concrete, Stucco	.403	.234	.152	.124	.119	.101
19	8″ Cinder Concrete, Stucco	.348	.214	.143	.118	.113	.097
20	10″ Cinder Concrete, Stucco	.307	.199	.136	.113	.109	.093
21	12″ Cinder Concrete, Stucco	.274	.184	.129	.108	.104	.090
22	8″ Concrete Block	.348	.215	.144	.119	.114	.097
23	10″ Concrete Block	.305	.198	.136	.113	.108	.093
24	12″ Concrete Block	.271	.183	.128	.108	.104	.090

Section No.	Type of Construction	Not Insulated	½″ B-W	1″ B-W
	Walls, Frame			
25	Siding or Wood Shingles, Paper, Sheathing, Wood Lath & Plaster	.227	.122	.099
26	Brick Veneer, Paper, Sheathing, Wood Lath & Plaster	.216	.118	.097
27	Stucco, Paper, Sheathing, Wood Lath & Plaster	.257	.130	.105
	Ceilings			
28	Wood Lath & Plaster, No Floor Above	.502	.172	.131
29	Wood Lath & Plaster, 1″ Pine Flooring Above	.234	.124	.101
30	Wood Lath & Plaster, 1″ Pine, 13/16″ Oak or Maple Flooring Above	.202	.114	.094
	Partitions			
31	Studding, Wood Lath & Plaster One Side	.502	.172	.131
32	Studding, Wood Lath & Plaster Both Sides	.251	.128	.104
33	4″ Hollow Tile, Plaster One Side	.31 *	.181**	.135**
	Roofs			
34	Built-up Roofing on 1″ Roof Boards, Wood Lath & Plaster Inside	.258	.130	.105
35	Same as 34, with 2″ Roof Boards	.213	.117	.097
36	Wood Shingles on Roof Boards, No Inside Finish	.483	.170	.129
37	Same as 36, Wood Lath & Plaster Inside	.246	.127	.103
38	Asphalt or Asbestos Shingles on Roof Boards, No Inside Finish	.515	.174	.131
39	Same as 38, Wood Lath & Plaster Inside	.259	.130	.105
40	Slate or Tile on Roof Boards, No Inside Finish	.549	.177	.134
41	Same as 40, Wood Lath & Plaster Inside	.262	.131	.105
	†Roof & Ceiling Combined—Use Ceiling Area			
42	Wood Shingles, Wood Lath & Plaster Ceiling, No Attic Floor	.289	.137	.110
43	Same as 42, with Single Floor	.174	.105	.088
44	Asphalt or Asbestos Shingles, Wood Lath & Plaster Ceiling, No Attic Floor	.297	.139	.111
45	Same as 44, with Single Floor	.177	.106	.089
46	Slate or Tile, Wood Lath & Plaster Ceiling, No Attic Floor	.305	.141	.112
47	Same as 46, with Single Floor	.180	.107	.089
	Floors			
48	1″ Yellow Pine on Joists	.440	.164	.126
49	13/16″ Maple or Oak Flooring on 1″ Yellow Pine on Joists	.339	.148	.116
50	Same as 49 with ¾″ Matched Ceiling Boards Below	.270	.133	.107
51	4″ Concrete on 3″ Cinder Concrete on Ground	.556		
52	Same as 51 with 1″ Tile Flooring on Concrete	.526		
53	Same as 51 with 1″ Pine on Wood Sleepers Imbedded in Concrete	.388		
54	Same as 53 with 13/16″ Oak or Maple Flooring	.308		

*Plastered Direct **One furring strip
†Figured on basis of ½ pitch roof; sufficiently accurate for roofs of ¼ pitch or more.

Method of Calculating Radiation Requirements

General It is generally conceded that the B. t. u. method of calculating radiation requirements is the best which has been developed to date because it takes into consideration the actual heat loss through the glass areas, walls, floors and roof as well as that due to infiltration. There is a loss of heat in each instance whenever a difference in temperature exists between the inside and outside of the room. The addition of BALSAM-WOOL to a wall, ceiling, or roof reduces the heat loss through that section by as much as 75%.

Glass, walls and other component sections Each of these sections has a known coefficient of heat transmission which, when multiplied by its area and the temperature difference, gives the number of heat units lost each hour. The sum of these losses together with the heat necessary to raise the temperature of the incoming air to room temperature, divided by the number of heat units given off per hour per square foot of radiation, gives the amount of radiating surface required.

Infiltration The losses through the glass, walls and other component sections of a room may be accurately estimated, but infiltration is dependent upon the tightness of the windows, doors, and their frames, the windproofness of the wall itself and the exposure to the prevailing winds. It is estimated that the air in a room changes from ½ to 3 times per hour, depending upon conditions. In most cases, it is good practice to assume the air changes in a room according to the number of walls exposed. Table III gives a schedule for rooms in connection with residences.

Exposure The coefficients of heat transmission given in Table VI are based on a wind velocity of 15 miles per hour, therefore, in most cases no allowance need be made for exposure. However, there are times when a residence is not protected in any way by surrounding buildings and is severely exposed to the elements; in this case an allowance of 15% should be made for the rooms exposed to the prevailing wind, and 10% for the rooms with adjoining exposures. For example, a room has north, west, and south exposures with a prevailing wind from the west; add 15% for the west exposure. For rooms having north or south but no west exposure, add 10%; no allowance for east exposure. In each case, add only for the extreme exposure, **not** for the sum of all the exposures.

Warm air heating For warm air heating, the heat loss is estimated in exactly the same way as described below. While the use of insulation does not make it possible to reduce the size of a warm air heating plant, the saving of 25% to 40% in fuel each year, due to the BALSAM-WOOL, also applies to residences heated by this method.

Method of Computation

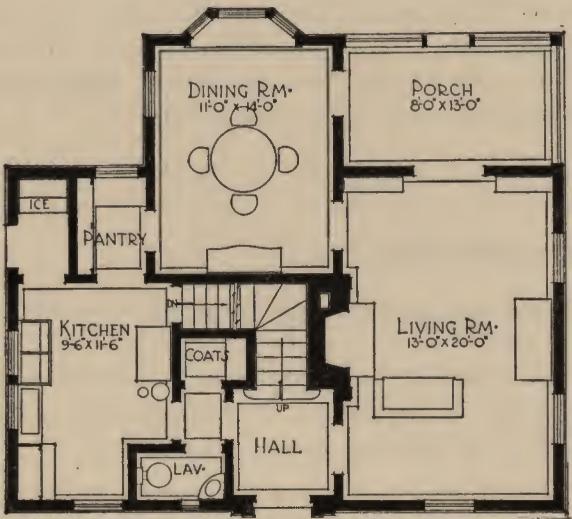
To compute the amount of radiation required for any given space proceed as follows:

1. Compute the loss through the windows and doors; i.e., area x coefficient x temperature difference=B. t. u. loss per hour. (Table II)

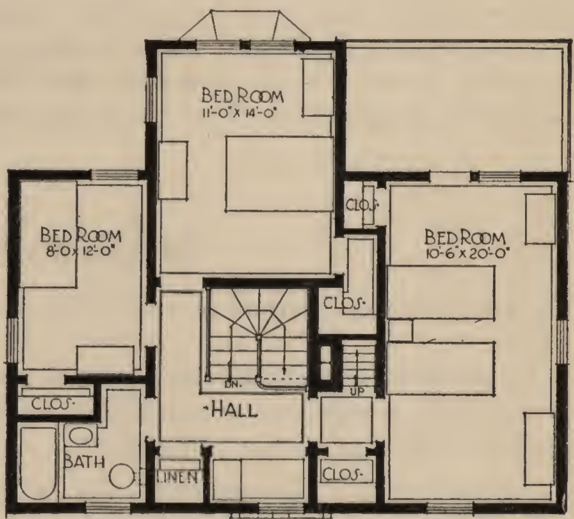
2. Compute the loss through the walls, floors and ceiling; i.e., area x coefficient x temperature difference=B. t. u. loss per hour. (Table VI)

3. Compute the loss due to infiltration; i.e., volume x coefficient x temperature difference =B. t. u. loss per hour. (Table IV)

4. The sum of these losses divided by 150 for hot water or 240 for steam radiation gives the number of square feet of radiation required.



First Floor Plan



Second Floor Plan

The example of the method used in calculating radiation requirements and fuel saving, which appears on the following pages, is based on the six-room frame house shown above.

An Example of the Method Used in Calculating Radiation Requirements and Fuel Saving

(Based on the house shown on opposite page located in the vicinity of New York City)

SPECIFICATIONS

Wall	Frame—lap siding.
Ceiling	Lath and plaster—no floor above—unheated attic.
Roof	Wood shingle on open roof boards—⅓ pitch.
Insulation	1-in. BALSAM-WOOL flanged midway in air space between studding in side walls.
	1-in. BALSAM-WOOL flanged midway in air space between second floor ceiling joists or on top of second floor ceiling joists.
Windows and Doors .	Single.
Outside Temperature	0° (Average 40.3 for 212 days).
Inside Temperature .	70° (Bathroom 80°).
Heat Supply	Hot water (150 B. t. u. per sq. ft. of radiation).
Orientation	North facing.

TYPICAL CALCULATIONS

Living Room

Preliminary Calculations

Glass Area: Three 34''x 32'' two-light windows
2 French doors—2' 4'' x 6' 8''

3 x 18.5	=	55.5 sq. ft.
2 x 15.5	=	31.0 sq. ft.
		86.5 sq. ft.

Outside Wall Area: (9' 0'' between first and second floor, 8' 0'' ceiling height)

46.2 x 9' 0''	=	415.8 sq. ft.
Less Glass Area	=	86.5 sq. ft.
Net Wall Area	=	329.3 sq. ft.
Volume: 13' x 20' x 8' 0''	=	2080 cu. ft.

Calculation of Heat Loss

	Heat loss in B.t.u. Uninsulated	Heat loss in B.t.u. Insulated 1'' B.W.
Glass:		
Area x Coefficient x Temp. Diff.		
86.5 x 1.1 x 70	= 6660	6660
Wall:		
Area x Coefficient x Temp. Diff.		
329.3 x .227 x 70	= 5232	
329.3 x .099 x 70	=	2282
Volume:		
Cu. Ft. x Coefficient x Temp. Diff.		
2080 x .036 x 70	= 5241	5241
Total	17133	14183

Radiation Required

17133 ÷ 150 = 114 sq. ft. of radiation—uninsulated.

14183 ÷ 150 = 95 sq. ft. of radiation—insulated with 1'' Balsam-Wool.

TYPICAL CALCULATIONS

(Continued)

East Bedroom

Preliminary Calculations

Glass Area: Two 30′′ x 24′′ two-light windows

2 x 13	=	26.0 sq. ft.

Outside Wall Area (Including Closet):
(7′ 6′′ Ceiling Height)

22.5 x 7.5	=	168.8 sq. ft.
Less Glass Area	=	26.0 sq. ft.
		142.8 sq. ft.

Ceiling Area (Including Closet):

8.2 x 12.2	=	100.0 sq. ft.
2.5 x 4.0	=	10.0 sq. ft.
		110.0 sq. ft.

Volume:

8 x 12 x 7.5	=	720.0 cu. ft.

Calculation of Heat Loss

								Heat Loss in B.t.u. Uninsulated	Heat Loss in B.t.u. Insulated 1′′ B.W.
Glass:									
Area	x	Coefficient	x	Temp. Diff.					
26	x	1.1	x	70			=	2002	2002
Wall:									
Area	x	Coefficient	x	Temp. Diff.					
142.8	x	.227	x	70			=	2269	
142.8	x	.099	x	70			=		990
Ceiling:									
Area	x	Coefficient	x	Temp. Diff.					
110	x	.289	x	70			=	2225	
110	x	.110	x	70			=		847
Volume:									
Cu. Ft.	x	Coefficient	x	Temp. Diff.					
720	x	.027	x	70			=	1360	1360
Total								7856	5199

Radiation Required

7856 ÷ 150 = 53 sq. ft. of radiation — uninsulated.

5199 ÷ 150 = 35 sq. ft. of radiation — insulated with 1′′ Balsam-Wool.

SUMMARY

Room	Heat Loss in B.t.u. Uninsulated	Heat Loss in B.t.u. Insulated with 1″ B-W	Square Feet of Radiation Uninsulated	Square Feet of Radiation Insulated with 1″ B-W
Living Room	17,133	14,183	114	95
Dining Room	10,140	8,575	68	57
Kitchen	7,650	6,245	51	42
Pantry	1,740	1,205	11.5	8
Hall—Downstairs	2,515	2,205	17	15
Lavatory	1,135	700	7.5	5
West Bedroom	17,070	11,120	114	74
South Bedroom	11,100	7,545	74	50
East Bedroom	7,856	5,199	53	35
Hall—Upstairs	5,605	3,385	37	22.5
Bathroom	4,645	3,040	31	20
TOTAL	86,589	63,402	578	423.5

Sq. Ft. of radiation saved due to 1″ BALSAM-WOOL = 154.5
Per cent radiation reduction = 26.7

Method of Calculating Fuel Saving

In order to figure the amount of fuel required and the saving due to BALSAM-WOOL, the average outside temperature for the heating season must be known. This is taken from the weather bureau reports for the particular region in which the house is located. The average outside temperature for New York City is 40.3° for a heating season of 212 days. This gives an average drop of 70° to 40.3° = 29.7°. However, the original heat loss was computed on a temperature difference of 70°, so in order to convert that amount to the average drop of 29.7°, $\frac{29.7}{70}$ of the total hourly heat loss is used.

Another method of figuring the fuel required is the degree-day method. A "degree-day" is the product of one day of time and one degree of temperature. The total number of degree-days represents the product of the difference between the average inside and outside temperatures and the number of days per heating season; or, in other words, the heating load per season. Table V of this section lists the degree-days for some of the principal cities of the United States. For New York City this heating load is 5303 degree-days.

The examples of fuel saving shown below are based on average heating values for coal, oil and gas and an assumed boiler efficiency. Wherever possible, actual values should be determined before attempting to calculate the saving. The method of converting to values other than those used here is given on page 10 of this section.

Coal

With coal having an average heating value of 14,000 B. t. u. per pound and with 50% boiler efficiency (making 7,000 useful B. t. u. per pound), 13.7 lbs. are required per 1,000 degree-days per square foot of steam radiation, when figured from 0° to 70°. Hot water radiation requires 8.56 lbs. under the same conditions.

The two methods of computing the coal requirements are shown below:

Method I

$$\text{Tons of Coal} = \frac{\text{Hourly heat loss x hours per day x no. of days per heating season x average temp. diff.}}{\text{Useful B.t.u. per lb. of coal x lbs. per ton x original temp. diff.}}$$

$$\text{Tons of Coal, Uninsulated} = \frac{86,589 \times 24 \times 212 \times 29.7}{7000 \times 2000 \times 70} = 13.35$$

$$\text{Tons of Coal, Insulated with 1'' B-W} = \frac{63,402 \times 24 \times 212 \times 29.7}{7000 \times 2000 \times 70} = 9.78$$

Method II (Degree-day)

$$\text{Tons of Coal} = \frac{\text{Sq. ft. of radiation x lbs. of coal per sq. ft. of radiation x thousands of degree-days}}{\text{lbs. of coal per ton}}$$

$$\text{Tons of Coal, Uninsulated} = \frac{578 \times 8.56 \times 5.303}{2000} = 13.12$$

$$\text{Tons of Coal, Insulated with 1'' B-W} = \frac{423.5 \times 8.56 \times 5.303}{2000} = 9.61$$

The saving due to Balsam-Wool is about 3.5 tons per heating season, or 26.7%.

Oil

With oil having an average heating value of 140,000 B. t. u. per gallon and with 60% boiler efficiency (making 84,000 useful B. t. u. per gallon), 1.14 gallons are required per 1,000 degree-days per square foot of steam radiation, when figured from 0° to 70°. Hot water radiation requires .71 gallons under the same conditions.

The two methods of computing the oil requirements are shown on the following page:

Method I

$$\text{Gal. of Oil} = \frac{\text{Hourly heat loss x hours per day x no. of days per heating season x average temp. diff.}}{\text{Useful B.t.u. per gal. of oil x original temp. diff.}}$$

$$\text{Gal. of Oil, Uninsulated} = \frac{86{,}589 \times 24 \times 212 \times 29.7}{84000 \times 70} = 2225 \qquad \text{Gal. of Oil, Insulated with 1'' B-W} = \frac{63{,}402 \times 24 \times 212 \times 29.7}{84000 \times 70} = 1630$$

Method II (Degree-day)

Gal. of Oil = Sq. ft. of radiation x gals. of oil per sq. ft. of radiation x thousands of degree-days

Gal. of Oil, Uninsulated = 578 x .71 x 5.303 = 2175 Gal. of Oil, Insulated with 1″ B-W = 423.5 x .71 x 5.303 = 1595

The saving due to Balsam-Wool is about 590 gallons of oil per heating season, or 26.7%.

Gas

With gas having an average heating value of 550 B. t. u. per cubic foot and with 75% boiler efficiency (making 412 useful B. t. u. per cubic foot), 233 cubic feet are required per 1,000 degree-days per square foot of steam radiation, when figured from 0° to 70°. Hot water radiation requires 145 cubic feet under the same conditions.

The two methods of computing the gas requirements are shown below:

Method I

$$\text{Cu. Ft. of Gas} = \frac{\text{Hourly heat loss x hours per day x no. of days per heating season x average temp. diff.}}{\text{Useful B. t. u. per cu. ft. of gas x original temp. diff.}}$$

$$\text{Cu. Ft. of Gas, Uninsulated} = \frac{86{,}589 \times 24 \times 212 \times 29.7}{412 \times 70} = 453{,}700 \qquad \text{Cu. Ft. of Gas, Insulated with 1'' B-W} = \frac{63{,}402 \times 24 \times 212 \times 29.7}{412 \times 70} = 332{,}210$$

Method II (Degree-day)

Cu. Ft. of Gas = Sq. ft. of radiation x cu. ft. of gas per sq. ft. of radiation x thousands of degree-days

Cu. Ft. of Gas, Uninsulated = 578 x 145 x 5.303 = 444,440 Cu. Ft. of Gas, Insulated with 1″ B-W = 423.5 x 145 x 5.303 = 325,640

Saving due to Balsam-Wool is about 120,000 cu. ft. of gas per heating season or 26.7%.

When using the degree-day method with coal, oil or gas, having heating values other than those shown, or for different boiler efficiencies, multiply the quantity of fuel per sq. ft. of radiation given above by the ratio of the original useful heating value to the desired value. For example: boiler efficiency 40%, coal 12,000 B. t. u. per lb. making 4,800 useful B. t. u. per lb; 8.56 x $\frac{7000}{4800}$ = 12.5 lbs. coal per thousand degree-days per sq. ft. of hot water radiation when figured from 0° to 70°.

When using temperature differences other than 70°, multiply the values given for fuel per sq. ft. of radiation by the ratio of 70 to the new temperature difference. For example, with radiation figured for 70° to – 20°, multiply 8.56 x $\frac{70}{90}$ = 6.66 lbs. of coal per sq. ft. of hot water radiation per thousand degree-days, with coal having 14,000 B. t. u. per lb. and with 50% boiler efficiency.

G. F. GEBHARDT

MECHANICAL ENGINEER

INSPECTION TESTS AND CONSULTATION

OFFICE AND LABORATORIES
ARMOUR INSTITUTE OF TECHNOLOGY

CHICAGO

May 25, 1929

Wood Conversion Company,
Cloquet, Minnesota

Gentlemen:

We submit herewith the results of a test which we have conducted to determine the rate of heat flow through a sample of new improved Balsam-Wool with crepe paper liners submitted by you recently and described in your letter of May 17, 1929.

In making this test we have used the flat plate method and have expressed the results in the usual terms. The test was conducted at a mean temperature of 70 degrees Fahr. The results are as follows:

HEAT CONDUCTIVITY OF NEW IMPROVED BALSAM-WOOL WITH CREPE PAPER LINERS
FLAT PLATE METHOD

Thickness inches	Density Lbs. Cu. Ft.	Heat Conductivity Per 1-inch Thick.	B.t.u. Per Hour Per 0.913-inch Thick.
0.913	3.62	0.246	0.270

Respectfully submitted,

G. F. GEBHARDT

Per J. C. Peebles

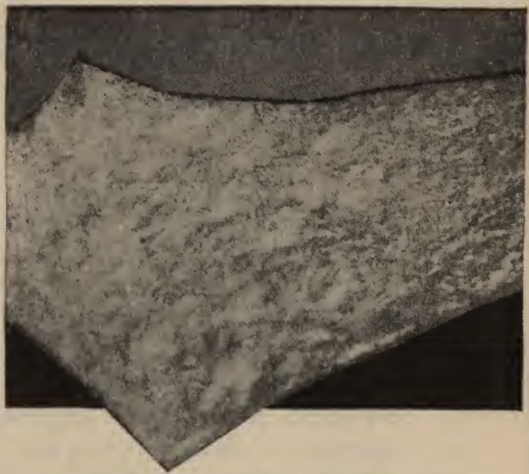
Testing Engineer:
J. C. Peebles

Balsam-Wool
Blanket

it tucks in

STANDARD SIZES
***and* PACKAGES**

Widths. . . . . 17, 25, 33 inches
Thickness. . . . . . . ½-inch and 1-inch
Packed: ½-inch—250 sq. ft. to roll
1-inch—125 sq. ft. to roll
Weight: ½-inch—240 lbs. per M sq. ft.
1-inch—370 lbs. per M sq. ft.



Section of Balsam-Wool in the full inch thickness. 92% of a cubic foot of Balsam-Wool is "still" air.

WOOD CONVERSION COMPANY
CLOQUET, MINNESOTA

Insulation Division Weyerhaeuser Forest Products

Makers of Balsam-Wool, the *Flexible* Insulating blanket
Also makers of Nu-Wood, the ALL-WOOD
Insulating Wall Board and Lath

DISTRICT SALES OFFICES

NEW YORK	WASHINGTON, D. C.	CHICAGO	KANSAS CITY
3107 Chanin Bldg.	531 14th St. N. W.	360 N. Michigan Ave.	321 W. 47th St.

DETROIT	MINNEAPOLIS	SEATTLE
515 Stephenson Bldg.	414 Baker Bldg.	621 Liggett Bldg.

Any Lumber Dealer Can Supply Balsam-Wool and Nu-Wood

Balsam-Wool Insulation

WOOD CONVERSION COMPANY
CLOQUET, MINNESOTA

SECTION 3

Specifications and Detail Drawings for the Application of Heat Insulation

NOTE—For technical data, including the coefficients for heat loss covering various types of construction, see Section 2. For general information, stock sizes, and other data on BALSAM-WOOL, see Section 1.

The Need for Heat Insulation

The need for heat insulation is no longer ques-ioned. Its importance is recognized today not nly by the architectural profession and the uilding trade, but by the general public as well.

What is more important, there is evident to-ay a new appreciation of the true function of nsulation as a vital part of modern heating quipment—the boiler or furnace to generate eat, the radiators or registers to distribute it, he insulation to keep it in. Informed home uilders and buyers today think of insulation, ot as a substitute for some structural part of he house, but as a *heat saver* essential to efficient nd economical house heating.

Vinter comfort The house which has been blanketed with true insulation as many definite advantages. In winter com-ortable temperatures can be easily maintained hroughout the house. There are no "cold north ooms". Insulation protects the house against he sudden changes of temperature which play uch havoc with comfort in an uninsulated ouse. The insulated house is also protected gainst the high winds which so often produce iscomfort in the uninsulated house even when he thermometer outside does not register ex-remely low temperatures.

ummer comfort Summer in the insulated house is not a season to be dreaded. Second floor rooms, after a hot ay, remain cool and sleep-inviting.

uel savings Thousands of insulated houses throughout the country are urning from 25% to 40% less fuel than nearby ninsulated houses of the same size. Important, because heating cost, particularly at present fuel prices, is the biggest single item of expense in the operation of most homes.

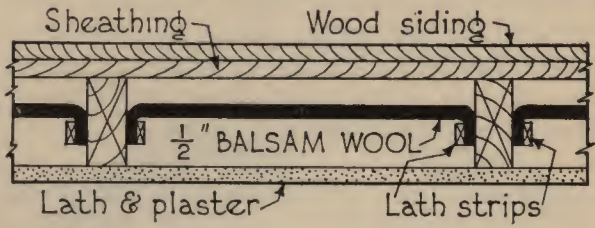
Less heating equipment Heating engineers suggest a substantial reduction in boiler capacity and radiation when insulation is specified. (See Section 2.) Thus the insulation cost can be offset to a large extent when the house is built.

Greater resale value In view of the many benefits of insulation it is superfluous to say that the insulated house is easier to sell. The advantages are too obvious, the cost too reasonable and the savings too large for any home-buyer to ignore. As the benefits of insulation become more generally known and as more and more people ask, "Is it insulated?" it becomes increasingly difficult to dispose of the uninsulated house and correspondingly easy to sell the house where year-round comfort and fuel economy are assured.

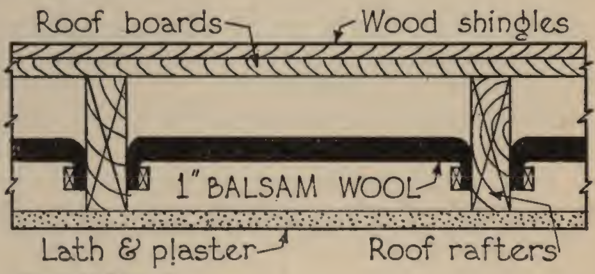
For moderate climates It would be a mistake to assume that the advantages of insulation are restricted to the more severe climates. In the warmer climates the principal purpose of insulation is to keep the heat out and thus increase hot-weather comfort. On the other hand, the average house in the mild winter climate is not built for warmth. Nor is there much attention paid to heating equipment. When a cold, raw day comes along there may be difficulty in keeping comfortably warm. In the insulated house a little heat goes a long way. In addition to that, wherever winter heating is necessary at all, proper heat insulation effects the same proportionate fuel saving as in the more severe climates.

Plate No. 1

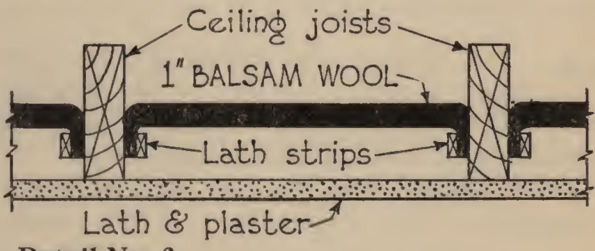
17-inch Balsam-Wool Flanged between Studdings, Rafters and Joists



Detail No. 1



Detail No. 2



Detail No. 3

For general data on the application of Balsam-Wool for Heat Insulation see Page 8 of this section

HEAT INSULATION SPECIFICATION No. 1

Frame, Brick Veneer or Frame Stucco

Balsam-Wool Flanged Between Studdings, Rafters and Joists

(Detail Drawings on Opposite Page)

Side Wall Insulation

1. **Material:** Heat insulation for outside walls shall be standard ½-inch* thick Balsam-Wool manufactured by Wood Conversion Company, Cloquet, Minnesota.

   ***Note to Specification Writer:** Additional thickness is advisable where the more expensive fuels are to be used. Balsam-Wool comes in both ½-inch and 1-inch thicknesses.

2. **Application:** (See Detail No. 1) Apply 17-inch width Balsam-Wool, vertically, between studding on all outside walls leaving an air space between sheathing and insulation. The flanges or turn-outs shall be continuously fastened by means of lath or strips nailed securely through insulation to the studdings on the sides and to sills, plates, or headers at top and bottom. Insulate thoroughly between joist ends. Throughout, all joints shall be made air-tight, especially at door and window openings. Use full length strips of insulation. End joints, where necessary, shall be lapped and covered with lath nailed through insulation to sheathing or header. *Maintain continuous insulation.*

Roof or Ceiling Joist Insulation

3. **Material:** Heat insulation for the roof shall be standard 1-inch Balsam-Wool manufactured by Wood Conversion Company, Cloquet, Minnesota.

   Application:

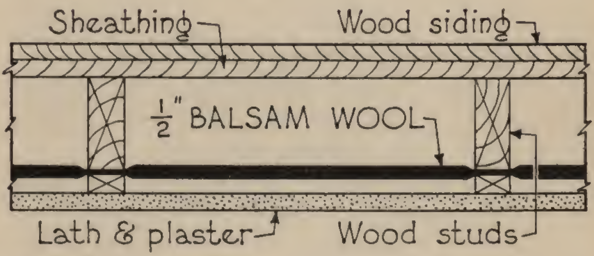
4. (A) Between Rafters. (See Detail No. 2) Apply 17-inch width Balsam-Wool between all rafters leaving an air space between roof boards and insulation. The flanges or turn-outs shall be continuously fastened by means of lath or strips nailed securely through insulation to the sides of rafters, plates, ridges, etc. Throughout, all joints shall be made air-tight, especially at ridge and plate. Use full length strips of insulation. End joints, where necessary, shall be lapped and covered with lath, nailed through insulation to roof boards or headers. *Maintain continuous insulation.*

5. (B) Between Ceiling Joists. (See Detail No. 3) Apply 17-inch width Balsam-Wool between all top floor ceiling joists. The flanges or turn-outs shall be continuously fastened by means of lath or strips nailed through insulation to sides of joists, plates, headers, etc. Throughout, all joints shall be made air-tight. Use full length strips of insulation. End joints, where necessary, shall be lapped and covered with lath, nailed through insulation to headers provided for that purpose. *Maintain continuous insulation.*

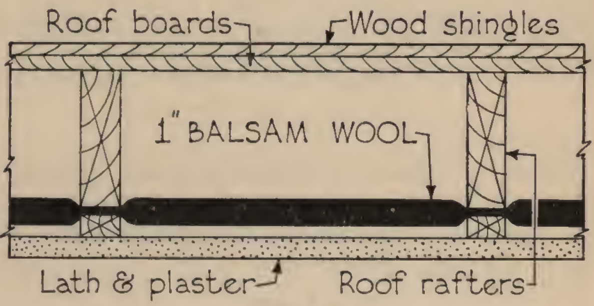
   Note: When framing members are 16-inch o. c. use 17-inch Balsam-Wool. When 24-inch o. c. use 25-inch Balsam-Wool.

Plate No. 2

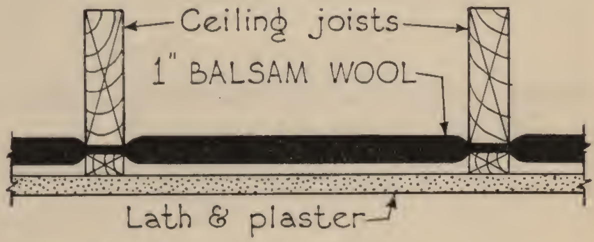
33-inch Balsam-Wool Applied to Face of Studdings, Rafters and Joists



Detail No. 4



Detail No. 5



Detail No. 6

For general data on the application of Balsam-Wool for Heat Insulation see Page 8 of this section

HEAT INSULATION SPECIFICATION No. 2

Frame, Brick Veneer or Frame Stucco

Balsam-Wool Applied to Face of Studdings, Rafters and Ceiling Joists

(Detail Drawings on Opposite Page)

Side Wall Insulation

1. **Material:** Heat insulation for outside walls shall be standard ½-inch* thick BALSAM-WOOL manufactured by Wood Conversion Company, Cloquet, Minnesota.

   ***Note to Specification Writer:** Additional thickness is advisable where the more expensive fuels are to be used. BALSAM-WOOL comes in both ½-inch and 1-inch thicknesses.

2. **Application:** (See Detail No. 4) Apply 33-inch width BALSAM-WOOL, vertically, on inside face of studding, edges butted together on every other stud. Fur over insulation with 1″x2″ furring strips on each stud to receive the lath and plaster. Throughout, all joints shall be made air-tight, especially the door and window openings. Use full length strips of insulation. End joints, where necessary, shall be lapped and covered with furring strips nailed through insulation to header provided for that purpose. *Maintain continuous insulation.*

   Note: This method requires special width door and window frames.

3. Where heating or plumbing pipes are installed in space between studs of outside walls insulate back of all such pipes with 17-inch BALSAM-WOOL, flanged between studding, in addition to insulation as above.

Roof or Ceiling Joist Insulation

4. **Material:** Heat insulation for the roof shall be standard 1-inch thick BALSAM-WOOL manufactured by Wood Conversion Company, Cloquet, Minnesota.

   Application:

5. (A) On Face of Rafters. (See Detail No. 5) Apply 33-inch width BALSAM-WOOL on the inside face of rafters, edges butted together on every other rafter. Fur over insulation with 1″ x 2″ furring strips on each rafter to receive lath and plaster. Throughout, all joints shall be made air-tight. Use full length strips of insulation. End joints, where necessary, shall be lapped and covered with furring strips nailed through insulation to header provided for that purpose. *Maintain continuous insulation.*

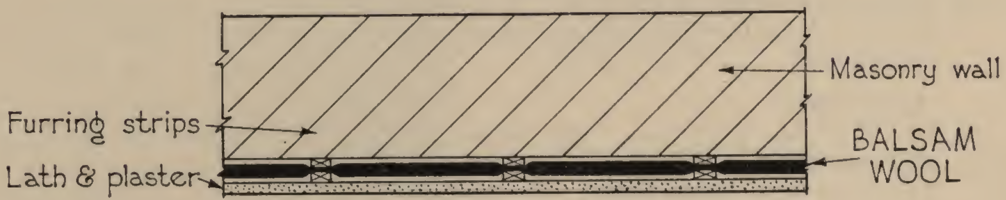
6. (B) On Ceiling Joists. (See Detail No. 6) Apply 33-inch width BALSAM-WOOL on the bottom of top floor ceiling joists, edges butted together on every other joist. Fur over insulation with 1″x 2″ strips on each joist to receive lath and plaster for ceiling. Throughout, all joints shall be made air-tight. Use full length strips of insulation. End joints, where necessary, shall be lapped and covered with furring strips nailed through insulation to header provided for that purpose. *Maintain continuous insulation.*

Plate No. 3

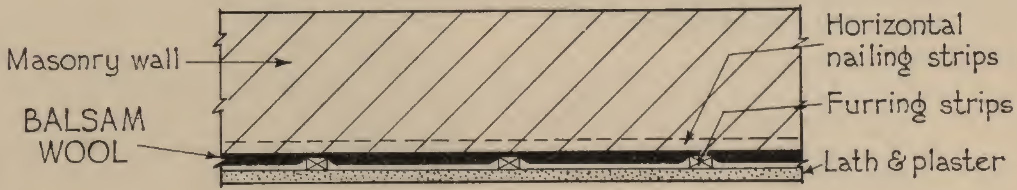
33-inch Balsam-Wool Applied on Masonry Walls

Double Furring Application

Single Furring Application



Detail No. 7



Detail No. 8

For general data on the application of Balsam-Wool for Heat Insulation see Page 8 of this section

HEAT INSULATION SPECIFICATION No. 3

Solid Brick, Hollow Tile, Stone, Concrete or Cinder Block Construction

Balsam-Wool Applied on Masonry Walls

(Detail Drawings on Opposite Page)

Side Wall Insulation—Method A

1. **Material:** Heat insulation for outside walls shall be standard ½-inch* thick BALSAM-WOOL manufactured by Wood Conversion Company, Cloquet, Minnesota.

*Note to Specification Writer: Additional thickness is advisable where the more expensive fuels are to be used. BALSAM-WOOL comes in both ½-inch and 1-inch thicknesses.

2. **Application:** Fur the wall with 1″x2″ furring strips, 16-inch o.c. shimmed plumb and true. Apply 33-inch width BALSAM-WOOL, vertically, on the inside face of furring, edges butted together on every other strip. Throughout, all joints shall be made air-tight, especially at door and window openings. Use full length strips of insulation. End joints, where necessary, shall be butted and covered with furring strip nailed through insulation to furring strip header, provided for that purpose. Insulation strips shall in all cases run in same direction as furring strips. Fur over insulation with 1″x2″ furring strips on each wall strip, to receive lath and plaster. *Maintain continuous insulation.*

Side Wall Insulation—Method B

3. **Material:** Heat insulation for outside walls shall be standard ½-inch* thick BALSAM-WOOL manufactured by Wood Conversion Company, Cloquet, Minnesota.

*Note to Specification Writer: Additional thickness is advisable where the more expensive fuels are to be used. BALSAM-WOOL comes in both ½-inch and 1-inch thicknesses.

4. **Preparation of Masonry Walls:** Instead of the usual nailing course of brick into which the furring strips are nailed, 1″x2″ furring strips shall be imbedded into the masonry wall every 16 inches to 24 inches, depending on size units used in constructing the wall. These strips should project not over ¼-inch from the surface of the wall. Plumb and true these strips to receive the insulation.

5. **Application:** Apply 33-inch width BALSAM-WOOL, vertically, on the inside wall, edges butted together. Throughout, all joints shall be made air-tight, especially at door and window openings. Use full length strips of insulation. End joints, where necessary, shall be butted on furring strips in masonry and covered with furring strip nailed through insulation to furring strip. Fur over insulation with 1″x2″ furring strips 16-inch o.c. nailed through insulation to the horizontal furring strip in walls to receive lath and plaster. Vertical furring strips shall be so spaced as to cover joints in insulation. *Maintain continuous insulation.*

Roof or Ceiling Joist Insulation

6. **Material:** Heat insulation for the roof shall be standard 1-inch BALSAM-WOOL manufactured by Wood Conversion Company, Cloquet, Minnesota.

Application:

7. (A) On Face of Rafters. (See Detail No. 5) Apply 33-inch width BALSAM-WOOL on the inside face of rafters, edges butted together on every other rafter. Fur over insulation with 1″x2″ furring strips on each rafter to receive lath and plaster. Throughout, all joints shall be made air-tight. Use full length strips of insulation. End joints, where necessary, shall be lapped and covered with furring strips nailed through insulation to header provided for that purpose. *Maintain continuous insulation.*

8. (B) On Ceiling Joists, (See Detail No. 6) Apply 33-inch width BALSAM-WOOL on the bottom of top floor ceiling joists, edges butted together on every other joist. Fur over insulation with 1″x2″ strips on each joist to receive lath and plaster. Throughout, all joints shall be made air-tight. Use full length strips of insulation. End joints, where necessary, shall be lapped and covered with furring strips nailed through insulation to header provided for that purpose. *Maintain continuous insulation.*

General Data on the Application of Balsam-Wool

How to Obtain Greatest Efficiency

To obtain the greatest efficiency and maintain continuity there are certain parts of the construction in the walls and roof which need special conscientious care. The properly insulated structure is heat-tight throughout. Any break in the insulating blanket leaks heat, just as a hole in a pan leaks water. Every effective means should be employed to conserve fuel and at the same time maintain a uniform, comfortable, healthful temperature.

The specifications and details given on the foregoing pages are for roof and side wall construction. They have purposely been made as brief as possible to avoid confusion and complication. For that reason vital points where insulation should be used have not been included, the insertion of these additional specifications being left to the discretion of the architect. Special attention of the designer and supervising architect is called to the following vital points:

1. Insulation should be applied between the floor joists against the beam filling or wall at the first story joist level.

2. Always carry the wall insulation continuously through the floor thickness at the second and attic story joists, that is, be sure to insulate the outside walls between the heads of all joists.

3. Be sure the insulation is tightly nailed at the roof plate (where the rafters join walls), and at the ridge. Great care should be taken here since usually it is diffcult to reach and is therefore often neglected, causing much heat loss.

4. Window and door frames should be given special attention. Caulk or pack with Balsam-Wool all open spaces accessible from the inside and wherever possible continue the wall insulation around the frames. In brick veneer construction with double hung windows, pulley pockets should be insulated on the outside by applying a strip of insulation over the sheathing and running around the frame.

5. Pay special attention to insulation of all roof areas or decks over heated rooms, as in the case of sun rooms, and to floors of heated rooms which project out over open porches or other unheated areas.

Where to Insulate the Roof

In specifying insulation for homes there is sometimes a question as to where to put the insulation for the roof. If the attic space is to be used for living quarters it is always advisable to place the insulation on or between the roof rafters. If the attic is to be used for storage space only, place the insulation on the ceiling line. This reduces the number of cubic feet necessary to heat and requires the minimum amount of insulation.

For this reason the standard specifications cover the application of the roof insulation placed in both the roof line and ceiling line. The location of the insulation is left entirely to the specification writer after determining the use to which the attic space is to be devoted.

Due to the fact that heat naturally rises, the greatest heat loss per square foot of surface is through the roof. In the summer most of the heat comes in the same way. For these reasons it is always advisable to use one-inch thickness Balsam-Wool for roof insulation.

Condensation In the Northern climates where extreme low temperatures prevail, the problem of condensation of moisture under the roof boards will have a bearing on the placing of the ins tion. Condensation difficulties are the result of wa moisture-laden air coming in contact with extremely roof surfaces. While there are many factors which affect a condensation problem, generally speaking, culties of this kind can be avoided by placing the i lation between the roof rafters or, if the insulatio placed in the attic floor, by providing ventilation o ings in the attic to carry off the warm, moist air.

The Engineering Department of the Wood Conver Company, Cloquet, Minnesota, will be glad to sub their recommendations on any specific condensa problem.

Added Insulation is an Economy

Were insulation a luxury—were the cost prohibitiv the house of moderate cost, it would be logical to in it only in the most vital parts of a building. The co insulation is, however, well within the reach of all will pay for itself many times over during the life house in fuel savings. Care and attention given to insulation and sound-deadening of certain rooms narily overlooked add but little to the original cost of house, but add much to the comfort and livablenes the home.

Since insulation can only, in most instances, be stalled during the construction of the building, insula should be considered in the following places in addi to those where it is customarily installed.

Basement ceiling The basement is always at much l er temperature than the living tions of the house. This usually sults in cold floors, draughts, and greater heat l Therefore, it is advisable to insulate the first story f or the basement ceiling. This must include the un side of the stairway to the second story and the parti walls enclosing the basement stairs.

Bedroom floors and walls General custom and hygienic r dictate that we sleep in cold b rooms. At night when the bedro heat is turned off and the windows opened, we imm ately create over the first story the equivalent of an heated attic space for a period of at least one-third each day. During this period there is a large loss of h (and fuel) from the first story ceiling to the second st By insulating the bedroom floors the temperature of first story can be maintained uniformly day and ni with resulting fuel economy, in addition to which th is the satisfaction of finding all except the sleeping ro warm and comfortable in the morning.

To carry this further and add to the economy maintain an even temperature throughout the house well to insulate the inside partition walls surround bedrooms which are kept at low temperatures during night. This will insure warm, cozy bathrooms dressing rooms. It is suggested that the doors be we er-stripped to further insure absolute temperature c trol.

Remember that the insulating of floors and partiti will also serve to sound-deaden them, which is alwa desirable feature. For this reason it is also advisabl insulate bathroom partition walls and wrap the soil pi

Balsam-Wool Insulation

WOOD CONVERSION COMPANY
CLOQUET, MINNESOTA

SECTION 4

Specifications and Detail Drawings for the Application of Sound Insulation

The Need for Sound Insulation

During the past few years the problem of sound-deadening all types of buildings has received an increased amount of attention, because of an insistence on the part of the public for a greater degree of quiet.

The demand by renters of apartments for the privacy and comfort to which they are justly entitled, the necessity for quiet rooms in hospitals, hotels, and office buildings have led architects and engineers to seek a material which will arrest the transmission of sound through walls and floors of such buildings.

The Problem of Sound Insulation

Many experts have made valuable contributions to the subject of sound insulation in buildings. Most of their experiments, however, have been devoted to the science of acoustical correction, and while methods of measuring the relative sound *absorbing* values of different materials have been rather definitely established, the measurement of sound *transmission* through floors and partitions is still in a state of experimentation.

There are many variable factors that effect the ultimate results. The structure of the building, thickness of walls, type and size of lumber used, dead load per square foot on floor, types of bearing plates, location of hallways, ventilating and elevator shafts, kind of flooring, and the method used in laying it—all have a decided effect upon the final results of the use of sound insulation.

Years of experience in the manufacture and sale of BALSAM-WOOL for sound insulation in many types of multiple dwellings, combined with laboratory research, have enabled us to arrive at some general conclusions and make recommendations based on this experience.

Types of sound In considering the problem of sound insulation it must be kept in mind that there are two distinct types of sound:

1. Air-borne sounds, or those carried in the air, such as those caused by talking, singing, violin, phonographs, radios, typewriters, etc.
2. Percussion sounds, or those that are generated in and progress through the building by structural vibration. These are caused by pounding, walking, dancing, children at play, moving of furniture, etc.

In the selection of a material to eliminate or reduce sound it is necessary to consider the manner in which the insulating material reacts to both types of sound.

Action of sound Sound travels in waves and is a form of energy. Thus when sound is generated on one side of a building partition the waves or vibrations strike the partition and set it in motion. This in turn transmits the sound through to the other side of the partition and it is then audible in the adjoining rooms.

Sound waves in their movements are either reflected, absorbed, or transmitted.

In offices, hospitals, and music rooms the problem of reflected sound is of major importance. This then becomes a sound absorption or acoustical problem and is dealt with as such.

The absorption and transmission of sound waves are the major problems in the insulation of multiple dwellings. We need to increase the sound absorption qualities of the structure and reduce its transmission of sound waves.

This is possible in only two ways—(1) Construct the building so massive that the vibrations set up in the structure itself are so small as to be inaudible. This is expensive and impractical in the majority of cases. (2) Build the floors and partitions to include a sound-absorbing material so that comfort and privacy can be secured. Due to its economy of space, material and cost and its practical features, the latter method is recommended. That this is possible has been proved, conclusively, not only by scientific tests, but by results of actual experience covering a number of years, and hundreds of jobs, including apartments, two-flats, hotels, and hospitals.

The Problem Confronting the Architect or Engineer

The problem confronting an architect or engineer today is to build an apartment or hotel so that a livable condition of privacy and quiet is assured the tenants under all conditions without sacrificing space and without resorting to a massive, expensive type of construction. To do so means the careful selection of sound insulating material and supervision of the installation to insure the maximum results, for only by the proper materials, correctly used, are these conditions assured.

Architects and engineers are urged to use the engineering and supervisory service maintained by the Wood Conversion Company to assist in the solution of sound-deadening problems.

Balsam-Wool is the Correct Sound Insulation

Balsam-Wool meets the exacting requirements of sound insulation. The asphalted Kraft paper liners present a hard surface to reflect sound waves, the thick "wool" blanket has proved a most efficient sound-absorbing material. Thus sound waves coming in contact with the material are both reflected and absorbed, allowing only a small percentage of the sound waves to penetrate the insulation.

Its flexibility makes it particularly usable in all types of construction and under varying conditions. Its fire resistance is a valuable asset as has been proved in numerous instances. It is clean and easily handled by the workmen. It i easily and quickly applied, without wast It is uniform in thickness, weight and textur Balsam-Wool is the ideal sound insulation.

Recommendations

The following recommendations are based o actual experience in hundreds of sound-deadene buildings throughout the country.

1. To secure the greatest degree of sound in sulation in buildings it is recommende that the suspended ceiling type of floo construction and the staggered studdin type of partition wall structure with Bal sam-Wool woven between the two sets o joists or studding be used. For specifica tions and details refer to pages 3 and 7 o this section.
2. For a more economical installation i apartments, hotels, and other multipl dwellings Balsam-Wool can be applie directly on the sub-floor and on one o both sides of single partition walls. De tails and specifications covering deadenin of floors are given on pages 4 and 5 of thi section. For those covering wall deaden ing see page 7.
3. All partitions in fireproof constructio should contain sound insulation. In gyp sum block walls the Balsam-Wool shoul be suspended vertically with joints lappe three inches, and the insulation extendin from ceiling to floor line. One-inch thick ness is recommended for this purpose Due to its flexibility, Balsam-Woo adapts itself readily to this type of con struction. Unlike a rigid material, Bal sam-Wool can be lapped to make a tigh joint between the strips. See pages 8 and 9
4. In the application of sound insulation it i recommended to lap all strips of materia three inches. Practical use has proved th impossibility of good sound insulation wit the edges of the material merely butted to gether. With Balsam-Wool not only i the possibility of a gap or opening eliminat ed, but the lapped edge gives an expose surface of wool that acts as an additiona sound-absorbing unit.

No sound insulating material can produce a effective result unless properly applied. Appli cation costs for a quality material are no highe than for those less efficient. Specify a qualit product and insist on its proper application.

SOUND INSULATION SPECIFICATION No. 1

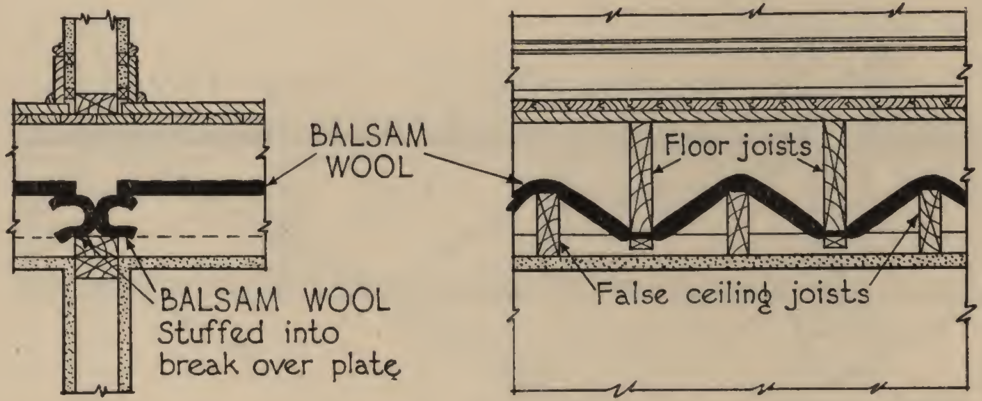
Balsam-Wool Applied With Suspended Ceiling Construction

Note: For Specifications and Details for Sound Insulation of Partitions, see pages 7, 8 and 9 of this section.

Material: Sound-deadening material (insulation) shall be standard ½-inch BALSAM-WOOL, 33 inches wide, manufactured by Wood Conversion Company, Cloquet, Minnesota.

Application: Over the entire surface of the ceiling of the............. and....................floors there shall be constructed a false ceiling, the joists supporting the floor and those carrying the ceiling being independent (the architect should here insert specifications for lumber to be used. If ceiling span is over 12 feet, 2x6's should be used, if less than 12 feet, 2x4's are sufficient). These ceiling joists shall be set midway between the floor joists with the under faces at least 1½ inches below those of the floor joists. Weave BALSAM-WOOL between the two sets of joists and secure to the bottom of each floor joist with lath or strips or tin discs, nailed through insulation. Insulation strips shall run at right angles to the joists with edges lapped at least 3 inches. Tension on all strips shall be as nearly equal as possible to guard against open joints at each lap.

Important: BALSAM-WOOL trimmings shall be packed and caulked on each side of false ceiling joists at point of suspension on plate. See detail.



Detail No. 9

SOUND INSULATION SPECIFICATION No. 2

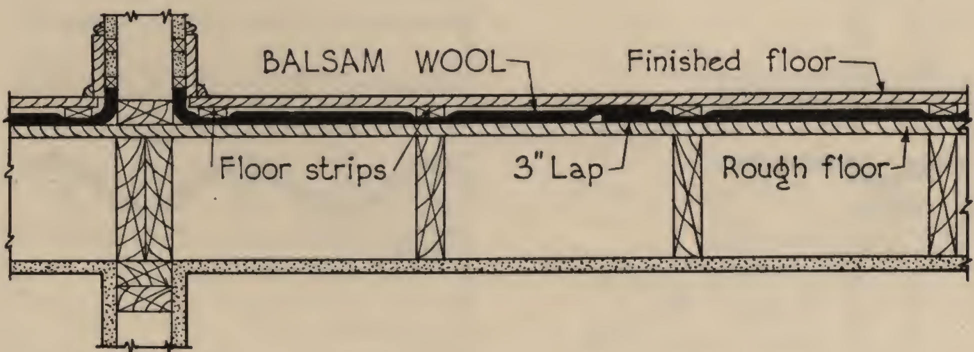
Balsam-Wool Applied Between Rough and Finish Floors Wood Joist Construction

Note: For Specifications and Details for Sound Insulation of Partitions, see pages 7, 8 and 9 of this section.

Material: Sound-deadening material (insulation) shall be standard 1-inch* BALSAM-WOOL, 33 inches wide, manufactured by Wood Conversion Company, Cloquet, Minnesota.

*While 1-inch is the recommended thickness, BALSAM-WOOL is also available ½-inch thick.

Application: Apply BALSAM-WOOL over the entire surface of the sub-floor, strips running parallel to joists. Lap all strips at least 3 inches. End joints, where necessary, shall be lapped 3 inches. Around all sides of room the insulation shall be turned up to the plaster ground. Continuity of sound-deadening shall be maintained. Use trimmings to thoroughly pack and caulk all pipe and conduit outlets. Over the surface of sound insulation there shall be applied 1″ x 2″ furring strips placed 16 inches o. c. spacing so that the laps of sound insulation come between the furring strips. Furring strips shall be nailed securely through insulation to sub-floor.



Detail No. 10

SOUND INSULATION SPECIFICATION No. 3

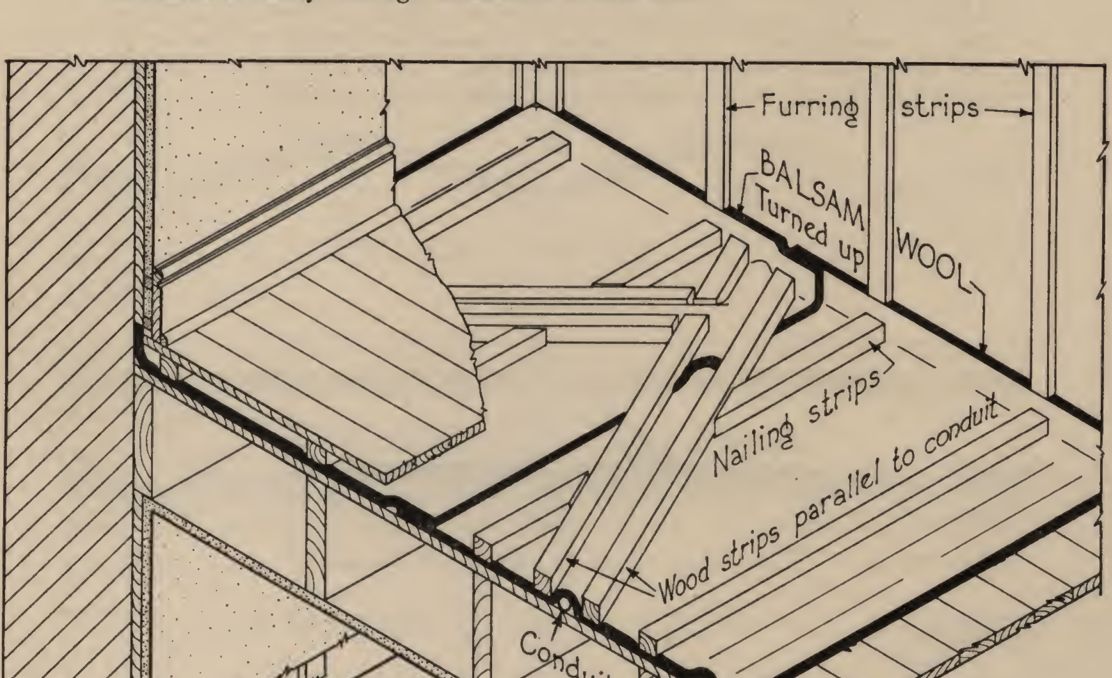
Balsam-Wool Applied Between Rough and Finish Floors When Electric Conduit Pipes Are Used

Note: For Specifications and Details for Sound Insulation of Partitions, see pages 7, 8 and 9 of this section.

Material: Sound-deadening material (insulation) shall be standard 1-inch* BALSAM-WOOL, 33 inches wide, manufactured by Wood Conversion Company, Cloquet, Minnesota.

*While 1-inch is the recommended thickness, BALSAM-WOOL is also available ½-inch thick.

Application: Apply BALSAM-WOOL over the entire surface of the sub-floor, over the electric conduits, strips running parallel to joists. Lap all strips at least 3 inches. End joints, where necessary, shall be lapped 3 inches. Around all sides of room the insulation shall be turned up to the plaster ground. Continuity of sound-deadening shall be maintained. Use trimmings to thoroughly pack and caulk all pipe and conduit outlets. 2″x2″ furring strips shall be laid parallel to and on both sides of all pipe or conduit, spacing strips 1-inch from conduits. Over the balance of the surface of sound insulation there shall be applied 2″x2″ furring strips placed 16 inches o. c. spacing so that the laps of sound insulation come between the furring strips and care being taken that they do not come in contact with the strips which are laid along the pipes or conduits. Furring strips shall be nailed securely through insulation to sub-floor.



Detail No. 11

SOUND INSULATION SPECIFICATION No. 4

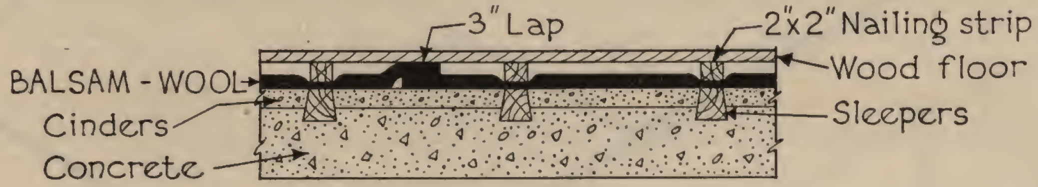
Balsam-Wool Applied on Concrete Floors

Note: For Specifications and Details for Sound Insulation of Fireproof Partitions, see pages 8 and 9 of this section.

Material: Sound-deadening material (insulation) shall be standard 1-inch *BALSAM-WOOL, 33 inches wide, manufactured by Wood Conversion Company, Cloquet, Minnesota.

*While 1-inch is the recommended thickness, Balsam-Wool is also available ½-inch thick.

Application: Apply BALSAM-WOOL over the entire surface of the floor, strips running parallel to the beveled sleepers which have been imbedded in concrete. Lap all strips of sound insulation at least 3 inches and space so that laps are between the sleepers in the concrete. End joints, where necessary, shall be lapped 3 inches. Around all sides of room the insulation shall be turned up to meet the plaster ground. Continuity of sound-deadening shall be maintained. Use trimmings of sound-deadening to thoroughly pack and caulk all pipes and conduit outlets. Apply 2″x2″ strips directly over every sleeper, nailing same through insulation into sleeper.



Detail No. 12

SOUND INSULATION SPECIFICATION No. 5

Balsam-Wool Applied in Frame Walls and Partitions

Note: For Specifications and Detail Drawings of Sound Insulation of Floors, see pages 3, 4, 5 and 6 of this section.

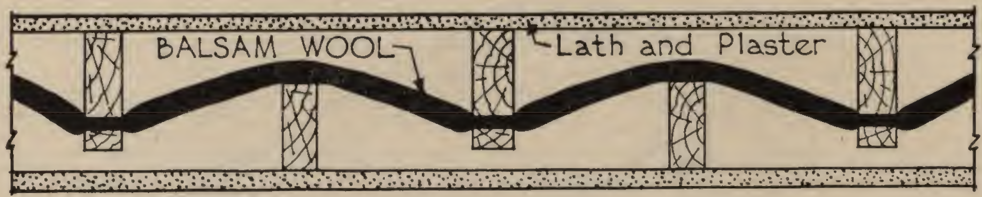
1. **Material:** Sound-deadening material (insulation) shall be standard 1-inch* BALSAM-WOOL, manufactured by Wood Conversion Company, Cloquet, Minnesota.

*While 1-inch is the recommended thickness, BALSAM-WOOL is also available ½-inch thick.

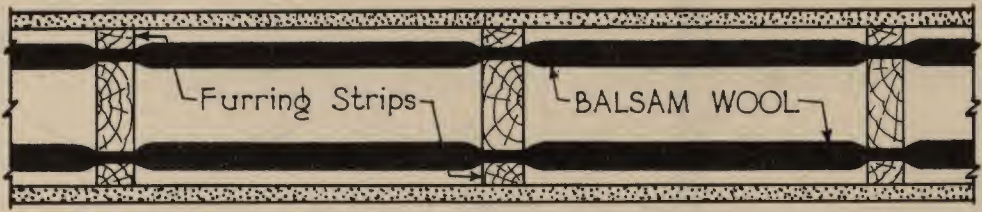
2. **Application: Method A.** (See Detail No. 13) All partition walls where specified shall be built of staggered studding construction, each set of studding set 16-inch o.c., one set centering between the other. On the same side of the partition there shall be at least 1-inch from the face of one set of studding to the face of the other. Weave BALSAM-WOOL between the two sets of studding and secure it to the face of one set with lath or strips (or tin discs), nailed through insulation. Lap all joints at least 3 inches. Tension on all of the strips shall be as nearly equal as possible to guard against open joints at each lap.

3. **Method B.** (See Detail No. 14) Apply one layer of 33-inch width BALSAM-WOOL, vertically, on each of the two faces of studding, butting edges together on every other stud. Continuity of sound-deadening shall be maintained. All joints shall be sealed. Use full length strips of insulation. End joints, where necessary, shall be butted and covered with lath nailed through insulation to stud or header. Fur over insulation with 1″x2″ furring strips over each stud to receive lath and plaster.

4. **Method C.** (See Detail No. 15) Apply 33-inch width BALSAM-WOOL, vertically, on one face of partition studding, butting edges together on every other stud. Continuity of sound-deadening shall be maintained. All joints shall be sealed. Use full length strips of insulation. End joints, where necessary, shall be butted and covered with lath nailed through insulation to stud or header. Fur over insulation with 1″x 2″ furring strips over each stud to receive lath and plaster.



Detail No. 13



Detail No. 14

Detail No. 15

Plate No. 4

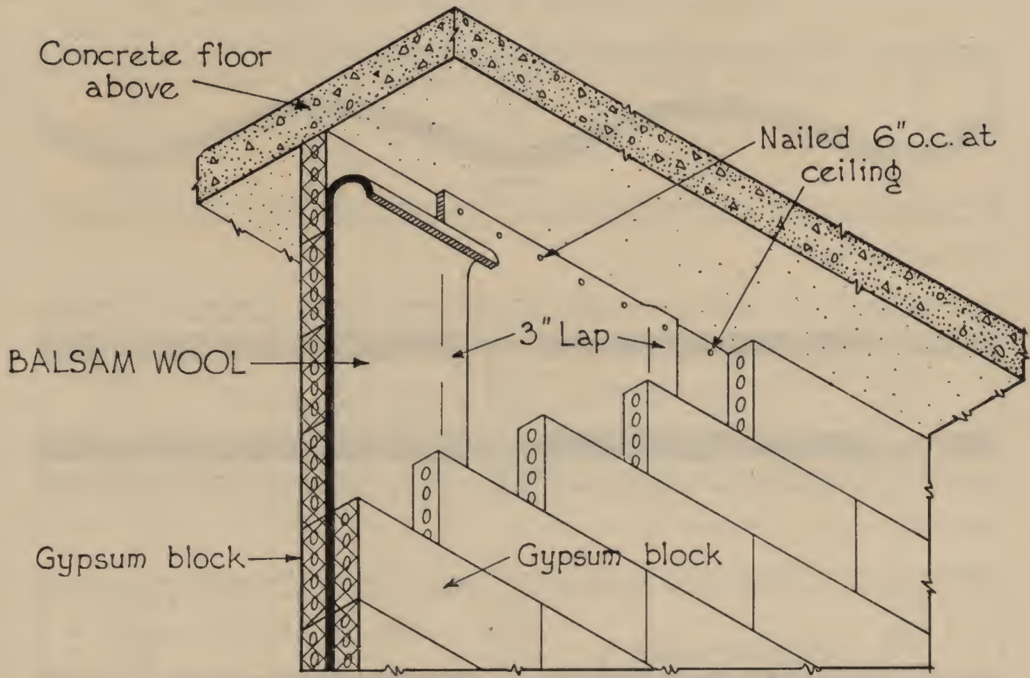
Balsam-Wool Applied in Gypsum Block Partition Walls

DOUBLE GYPSUM BLOCK PARTITION

Detail No. 16

SINGLE GYPSUM BLOCK PARTITION

Detail No. 17



ISOMETRIC SHOWING BALSAM WOOL DEADENING IN GYPSUM BLOCK PARTITIONS

SOUND INSULATION SPECIFICATION No. 6

Balsam-Wool Applied on Gypsum Block Partition Walls

(Details on Opposite Page)

1. **Sound-deadening material** (insulation) shall be standard 1-inch *Balsam-Wool, 33 inches wide, manufactured by Wood Conversion Company, Cloquet, Minnesota.

   *While 1-inch is the recommended thickness, Balsam-Wool is also available ½-inch thick.

2. **Double Gypsum Block Partition Walls:** Erect one side of partition walls of gypsum blocks from floor to ceiling as elsewhere specified and directed. Apply 33-inch width Balsam-Wool, vertically, covering the entire surface of partition and lapping joints not less than 3 inches. Nail to gypsum blocks with large headed nails. Particular care should be taken to bring Balsam-Wool up to ceiling, floor and wall lines of partition. Then erect the other side of partition wall, with the inside face of gypsum blocks flush with surface of sound insulation.

3. **Single Gypsum Block Partition Walls:** Erect gypsum block partition as elsewhere specified and directed. Apply 33-inch width Balsam-Wool, vertically, covering the entire surface of partition, lapping joints not less than 3 inches. Nail to gypsum block with large headed nails. Particular care should be taken to bring Balsam-Wool tightly to ceiling, floor and wall lines of partition. Apply 1″x2″ furring strips, vertically, 16 inches on center, nailing through the sound insulation to gypsum block. Furring strips should be so placed that laps in sound insulation will come between them. All furring strips shall be plumb and true. Apply plaster base as specified to furring strips.

Note: If building code demands steel furring strips and metal lath apply Balsam-Wool in the same manner and substitute specifications covering this particular construction.

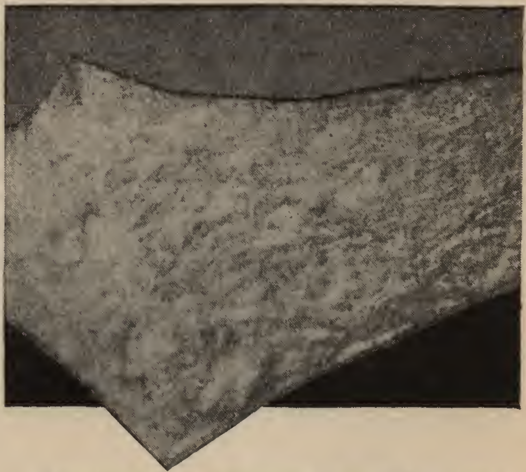
Balsam-Wool

Blanket

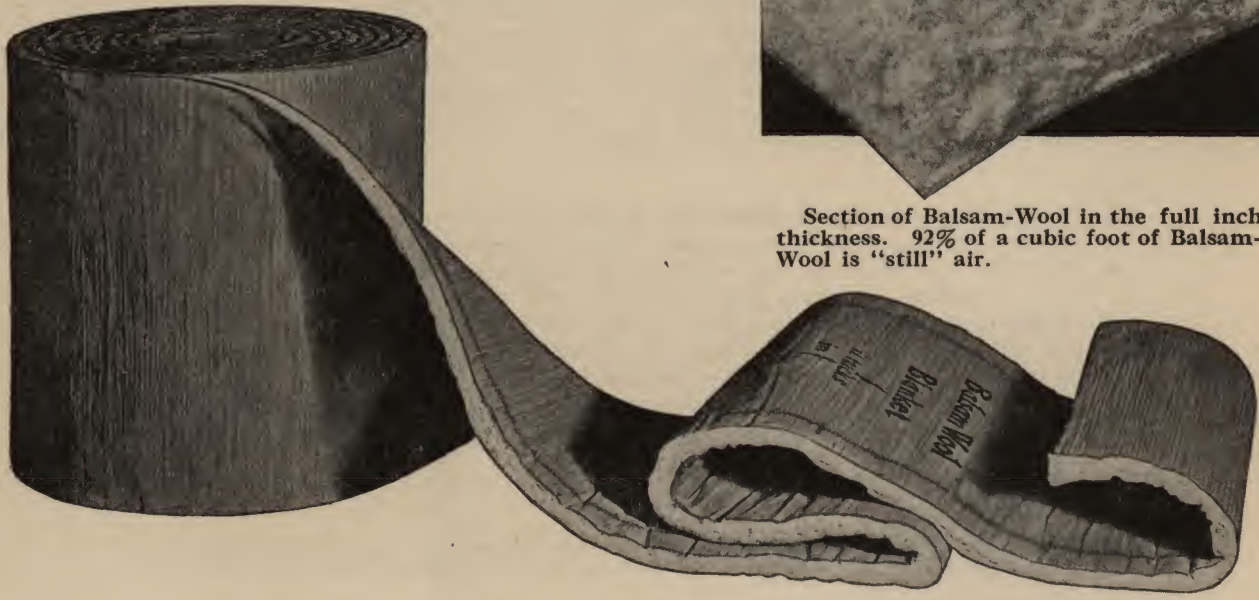
it tucks in

STANDARD SIZES
***and* PACKAGES**

Widths . . . . 17, 25, 33 inches
Thickness . . . . ½-inch and 1-inch
Packed: ½-inch—250 sq. ft. to roll
1-inch—125 sq. ft. to roll
Weight: ½-inch—240 lbs. per M sq. ft.
1-inch—370 lbs. per M sq. ft.



Section of Balsam-Wool in the full inch thickness. 92% of a cubic foot of Balsam-Wool is "still" air.



WOOD CONVERSION COMPANY

CLOQUET, MINNESOTA

Insulation Division Weyerhaeuser Forest Products

Makers of Balsam-Wool, the *Flexible* Insulating blanket
Also makers of Nu-Wood, the ALL-WOOD
Insulating Wall Board and Lath

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Any Lumber Dealer Can Supply Balsam-Wool and Nu-Wood